

REPORT DOCUMENTATION PAGE

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36 separate files are enclosed

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TP-FY99-0132

✓ Spreadsheet
✓ DTS

MEMORANDUM FOR PRR (~~Contractor~~/In-House Publication)

FROM: PROI (TI) (STINFO)

9 June 1999

SUBJECT: Authorization for Release of Technical Information, Control Number: AFRL-PR-ED-TP-FY99-0132
C.T. Liu, "Effects of Microstructure on Damage Evolution, Strain Inhomogeneity, and Fracture in a Particulate Composite"

Presentation slides/Invited Lecture
International Conference/Brussels, Belgium

(Public Release)



Effects of Microstructure on Damage Evolution, Strain Inhomogeneity, and Fracture in a Particulate Composite

C.T. Liu

Air Force Research Laboratory

AFRL/PRSM

10 E. Saturn Blvd.

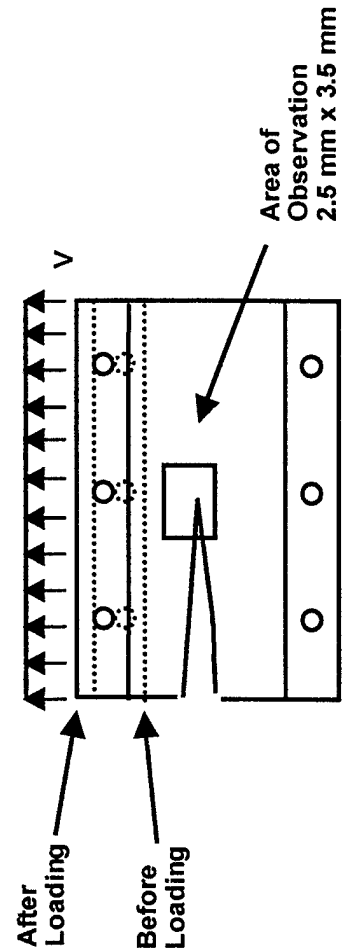
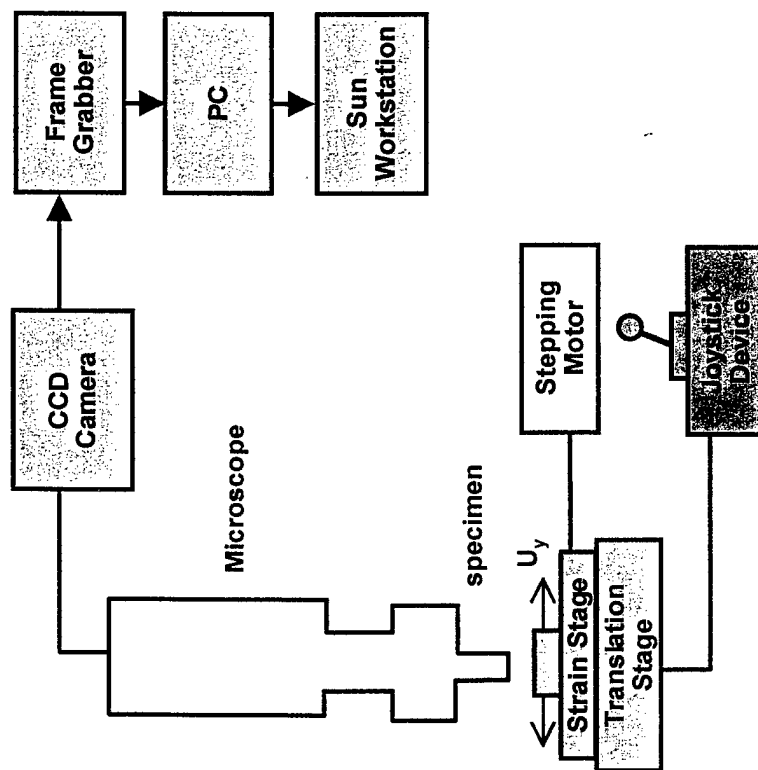
Edwards AFB, CA 03524-7680

20021119 108



Objective

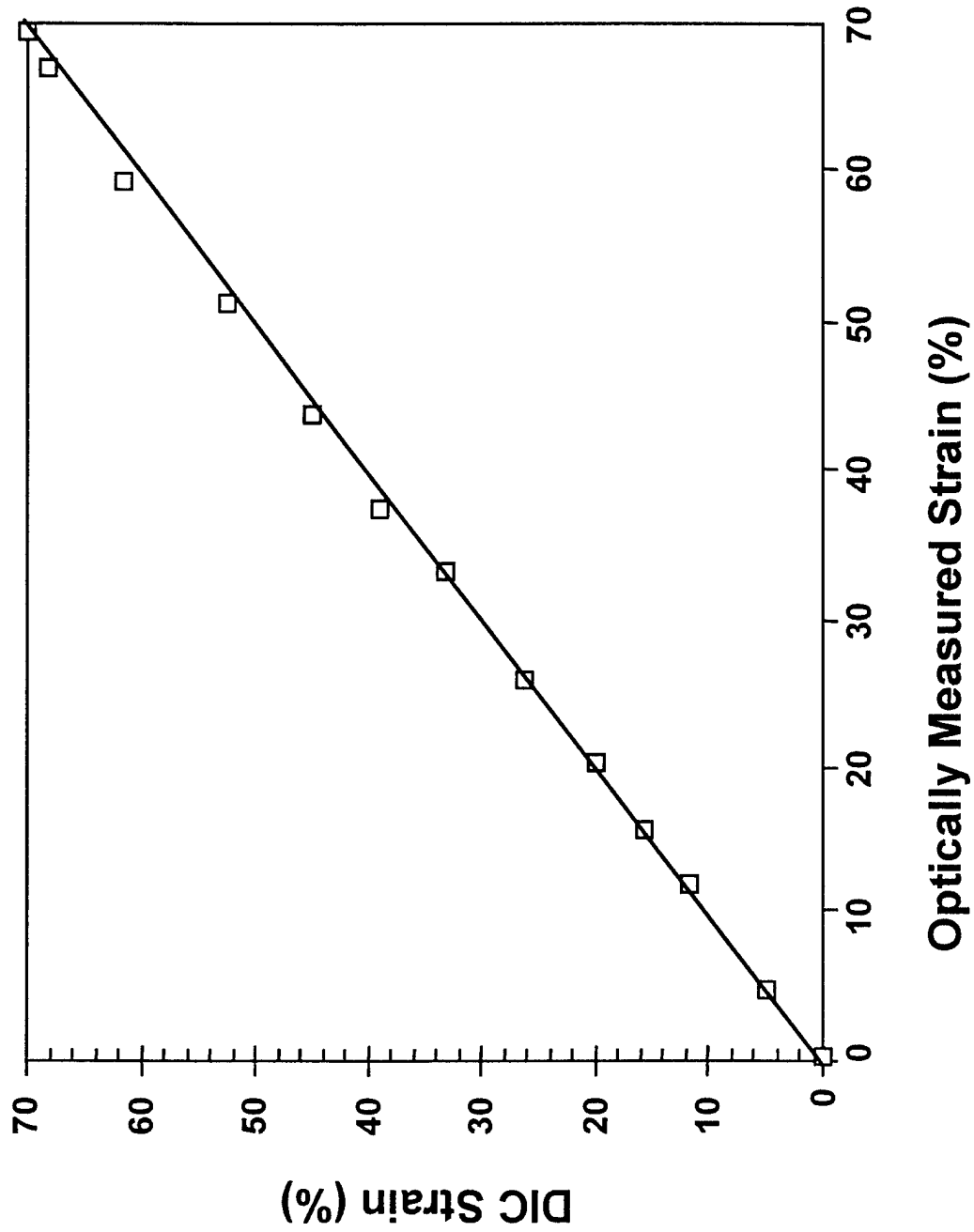
- Investigate the Effects of Microstructure of a Particulate Composite Material on Damage Mechanisms, Strain Fields, and Local Fracture Near the Crack Tip.





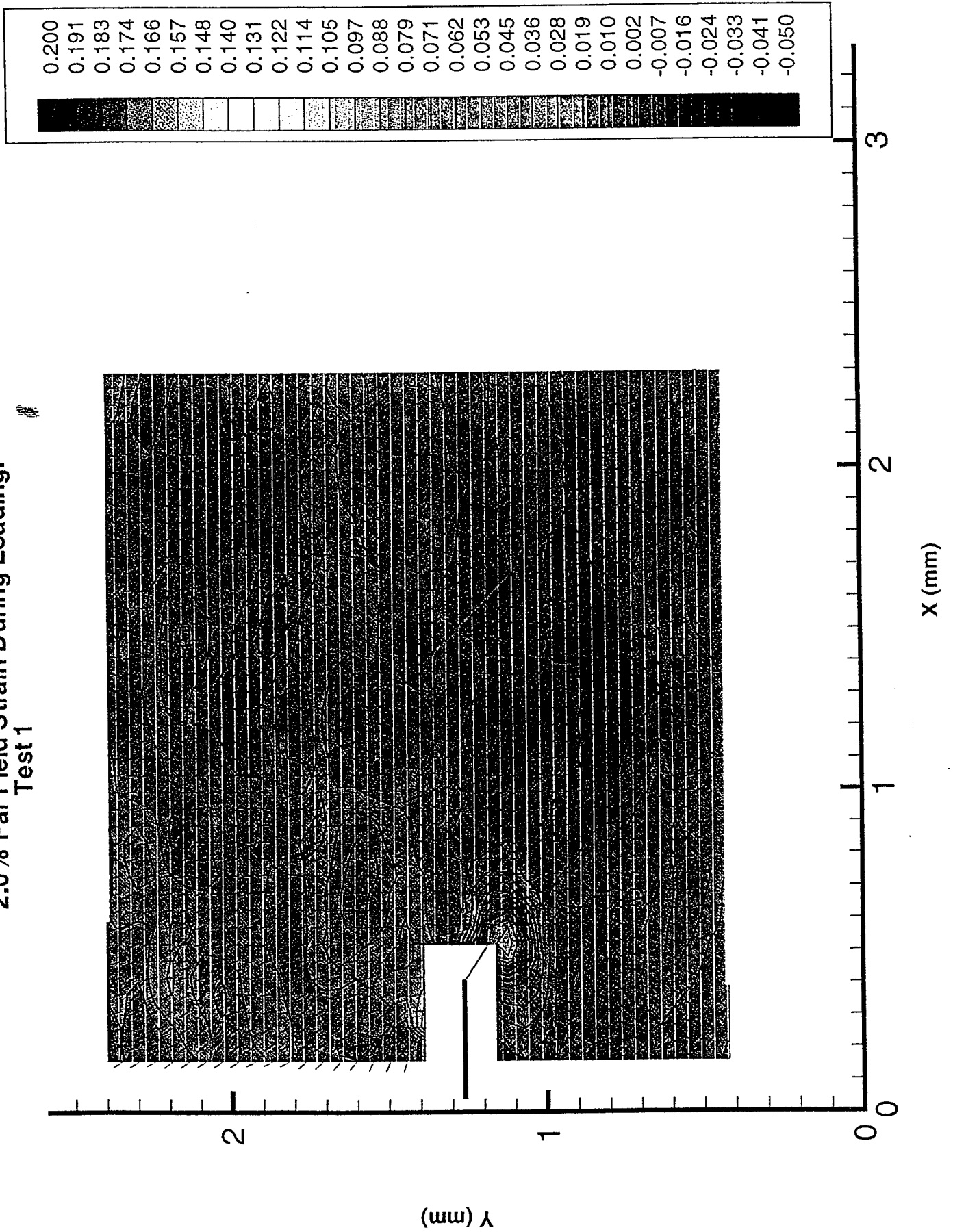
Calibration

D1559.



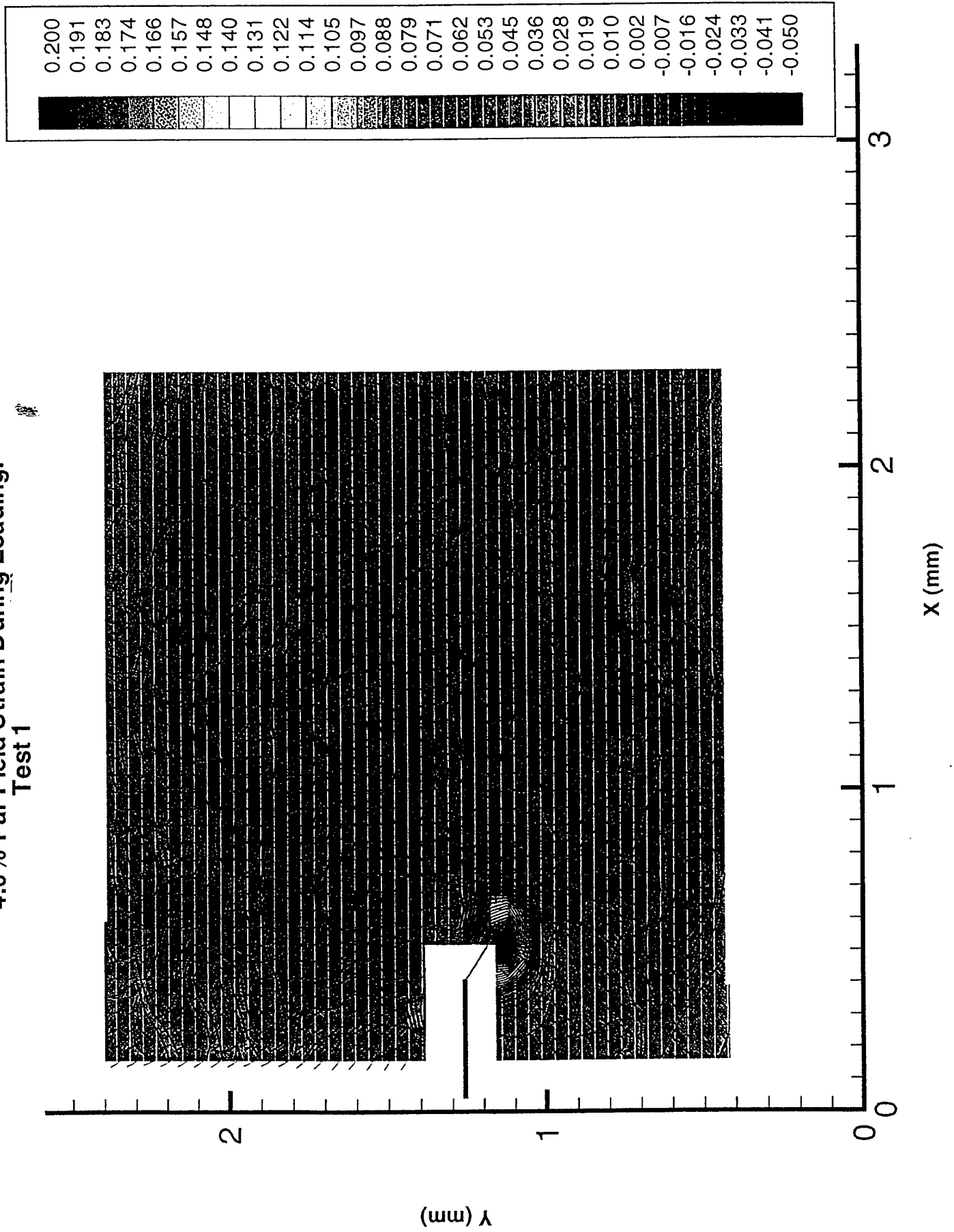
Maximum Principal Strain Distribution for
2.0% Far Field Strain During Loading.

Test 1

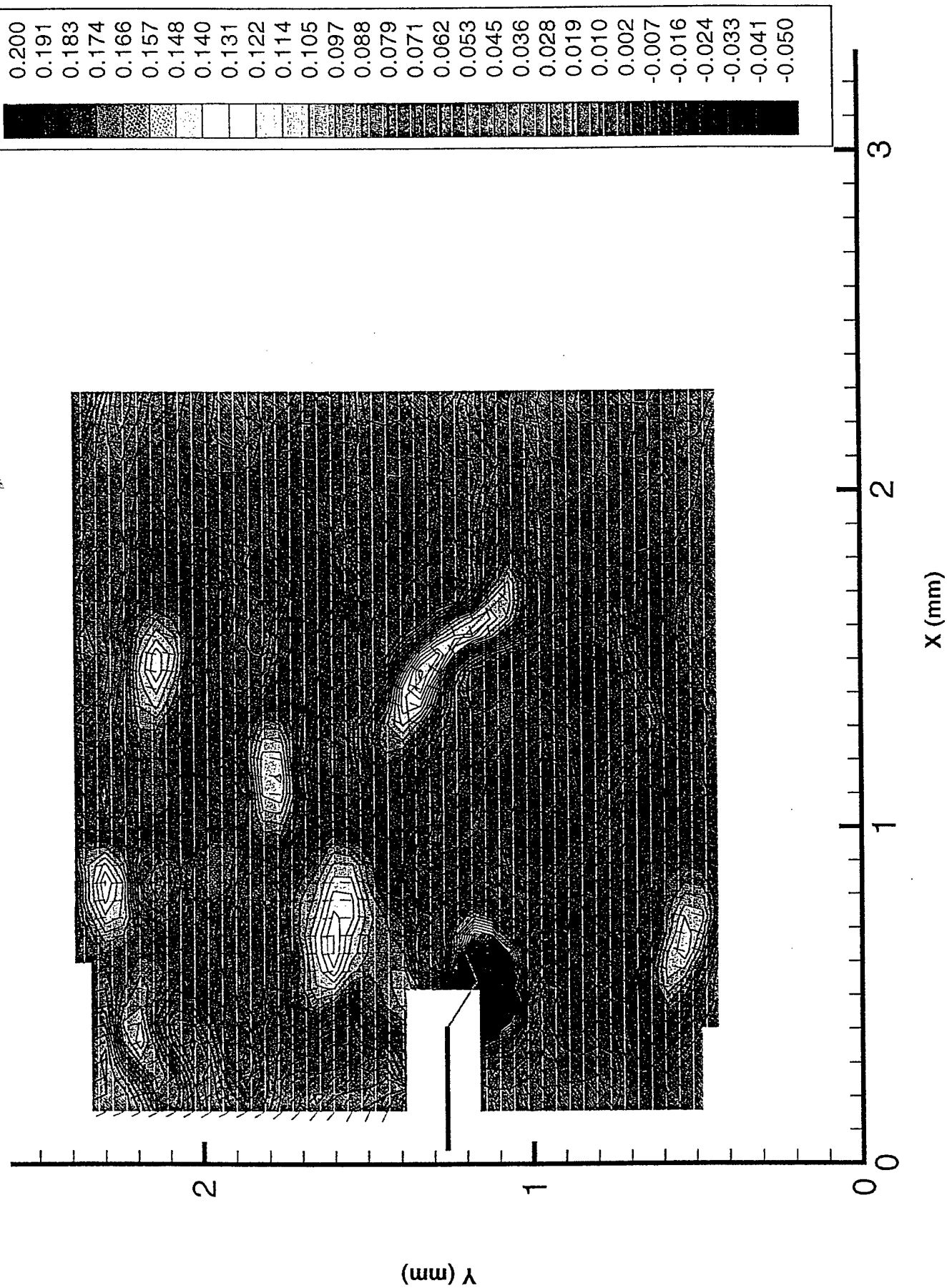


Maximum Principal Strain Distribution for
4.0% Far Field Strain During Loading.

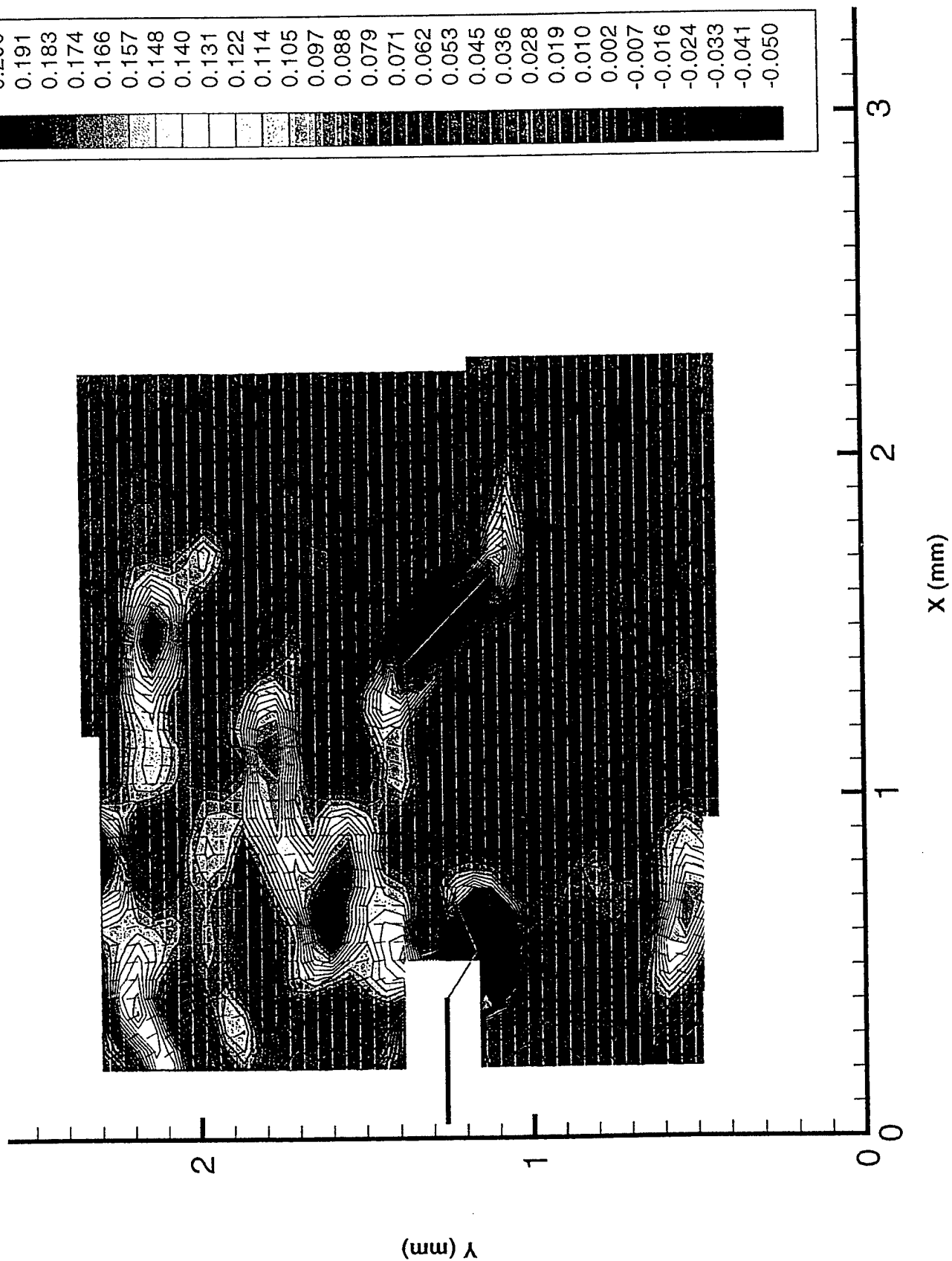
Test 1



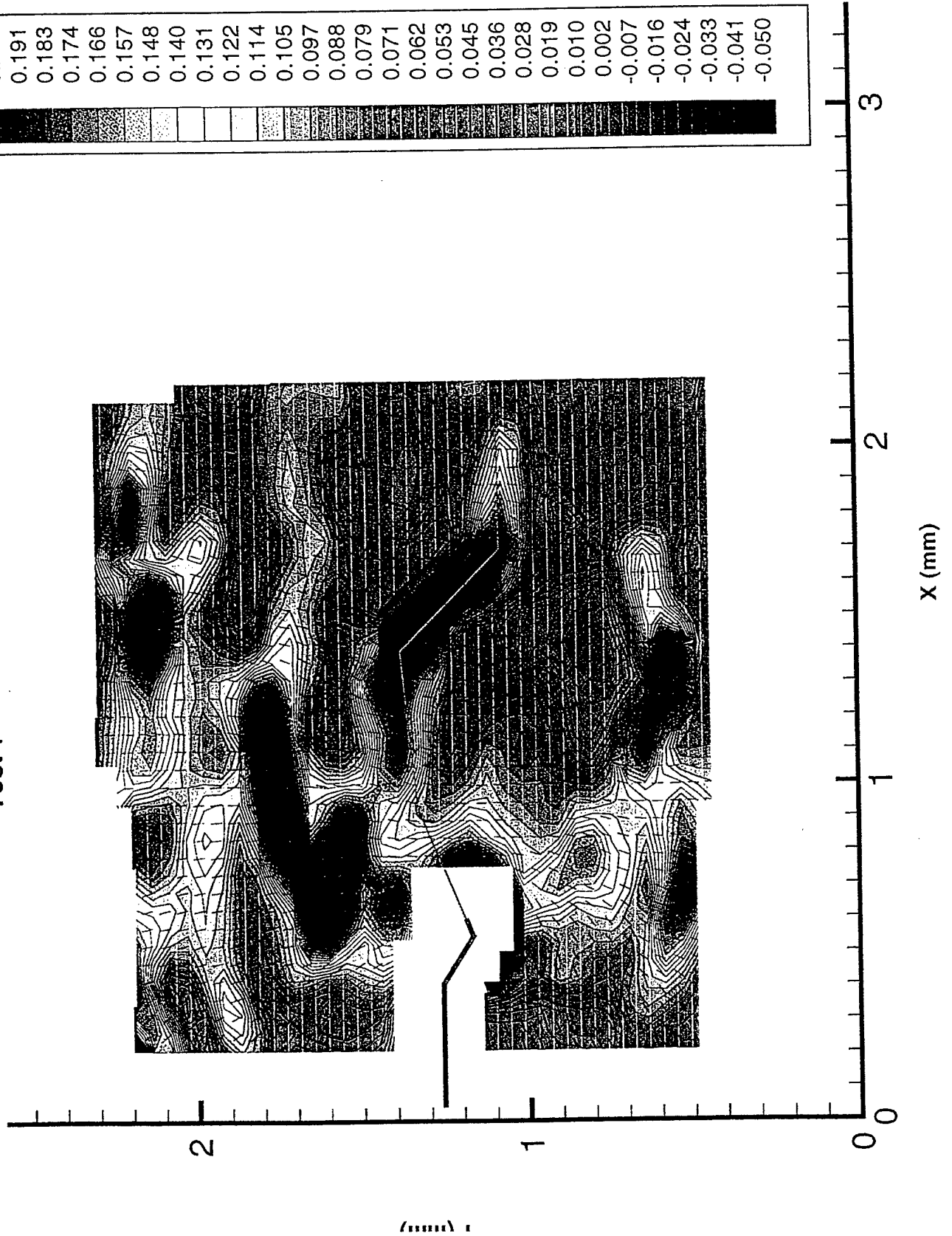
Maximum Principal Strain Distribution for
6.0% Far Field Strain During Loading.
Test 1

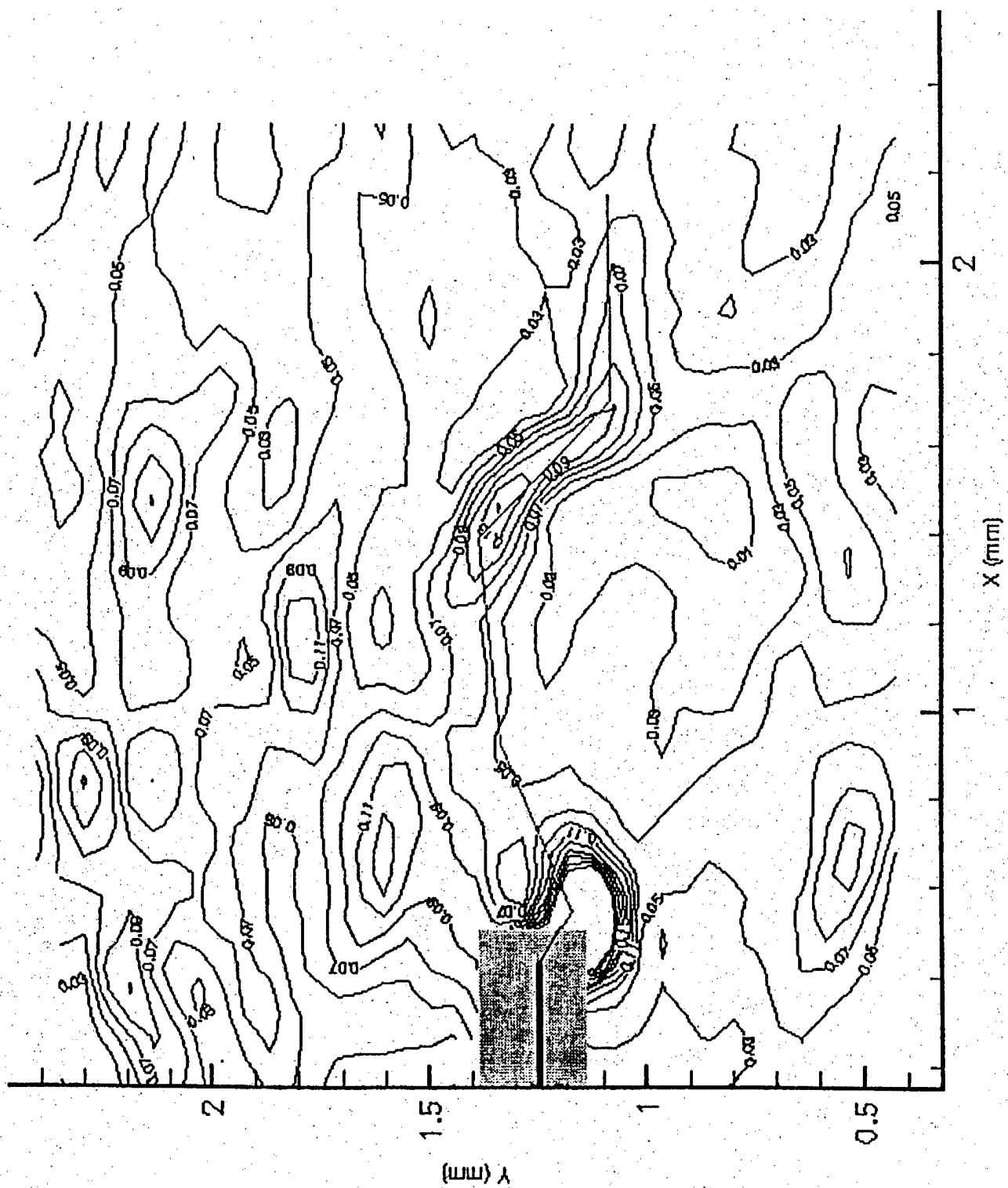


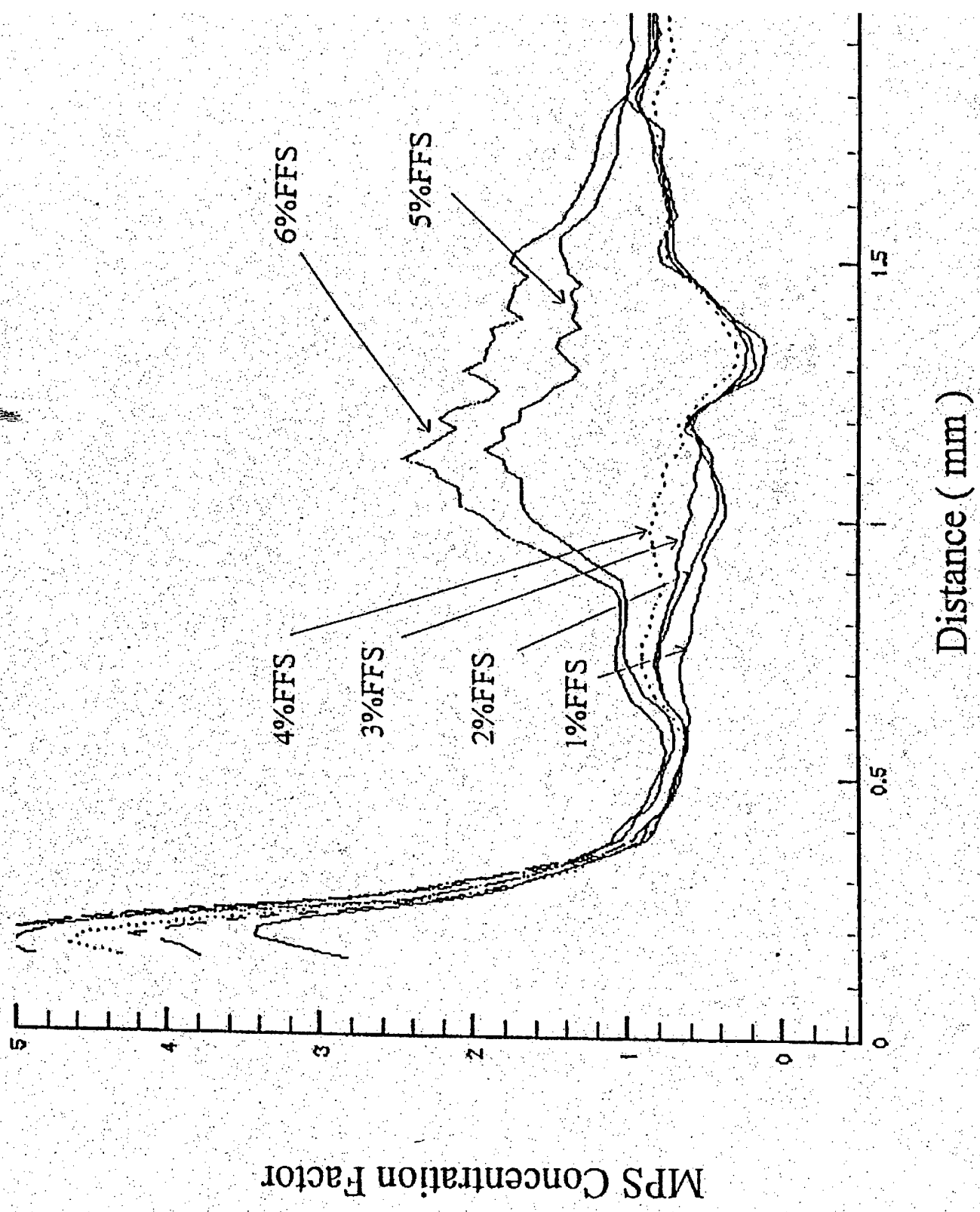
Maximum Principal Strain Distribution for
8.0% Far Field Strain During Reloading.
Test 1

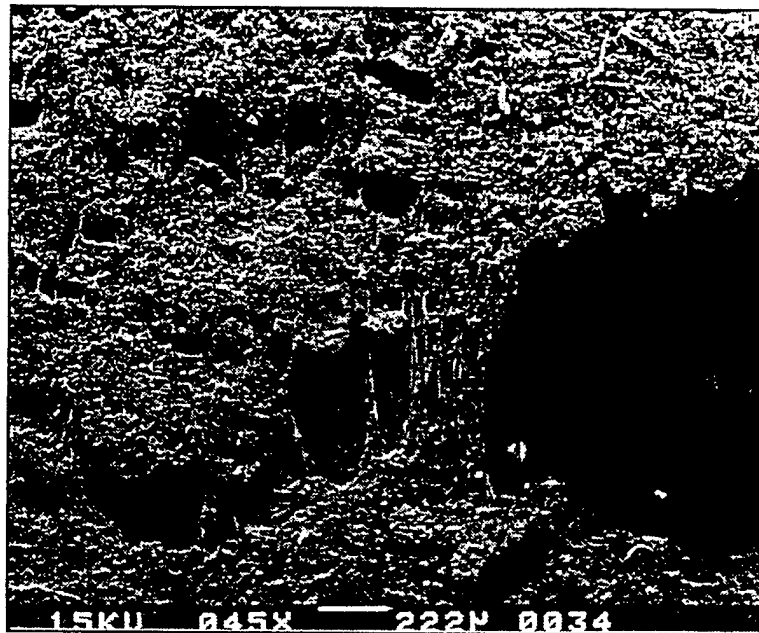


Maximum Principal Strain Distribution for
10.0% Far Field Strain during Reloading
Test 1



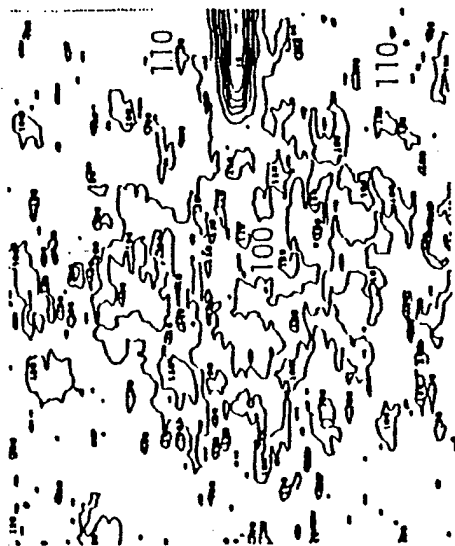








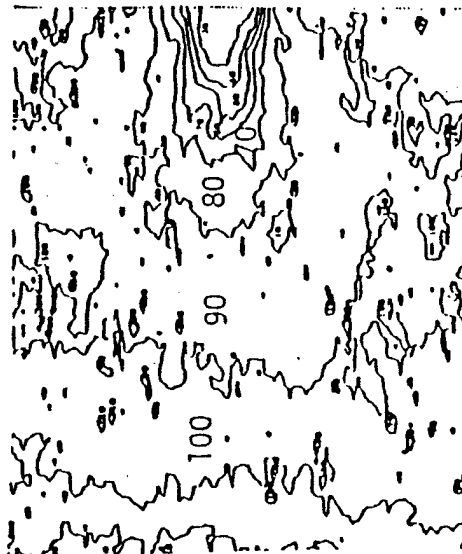
Iso-Intensity Contour Plots of I_t Near Crack Tip



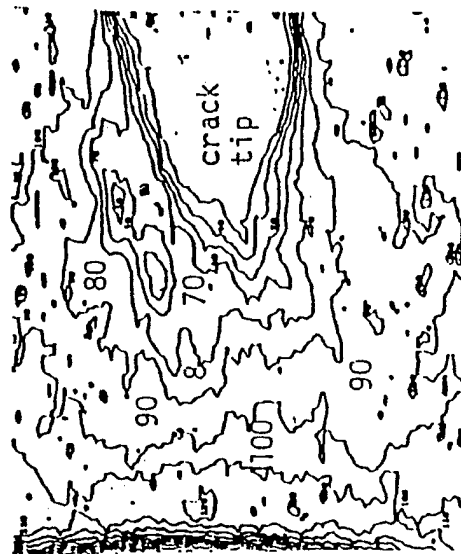
(a) $\epsilon = 3\%$



(b) $\epsilon = 6\%$



(c) $\epsilon = 9\%$

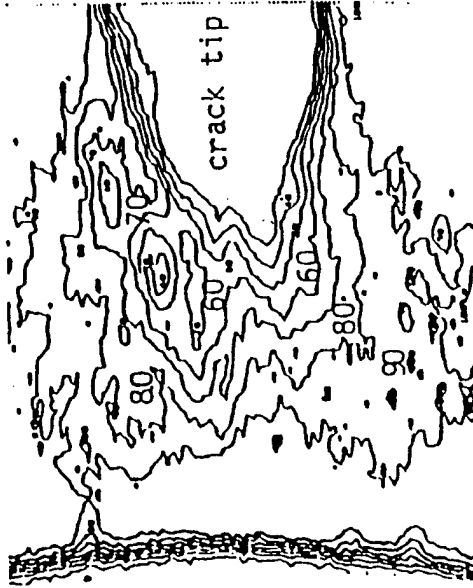


(d) $\epsilon = 12\%$

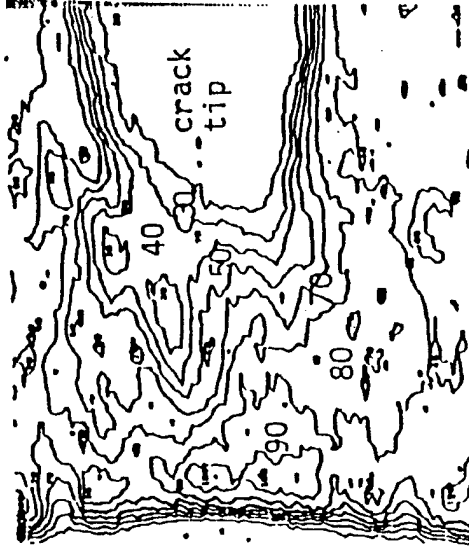


Iso-Intensity Contour Plots of I_t Near Crack Tip

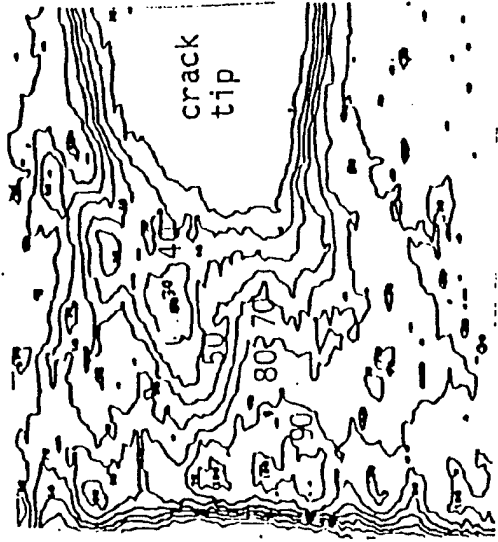
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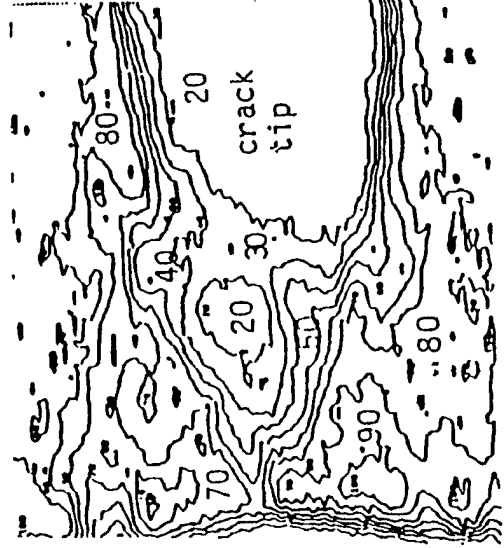
(e) $\epsilon = 13.5\%$



(f) $\epsilon = 13.5\%$



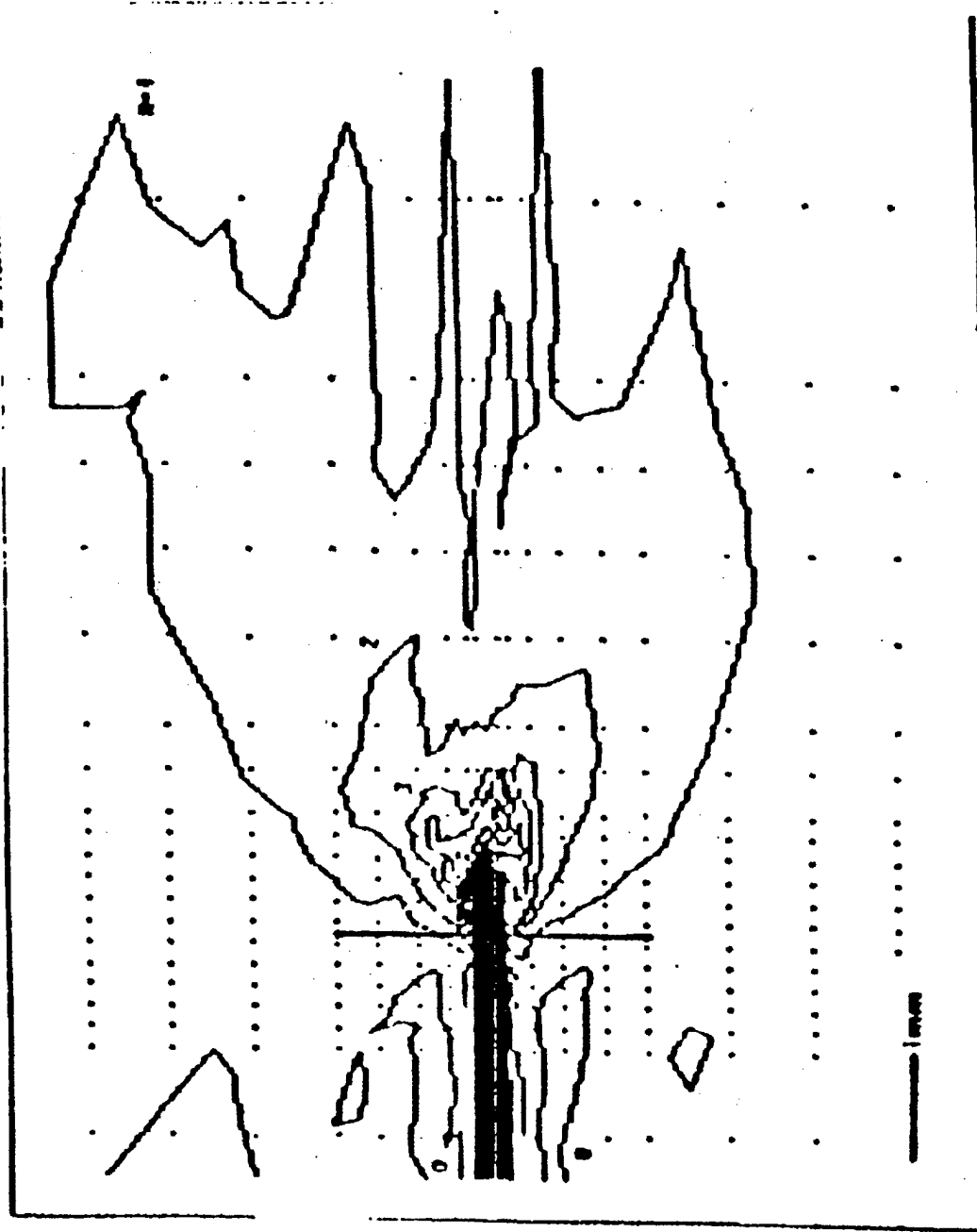
(g) $\epsilon = 13.5\%$



(h) $\epsilon = 13.5\%$



Normal Strain (Experimental Result)





Conclusions

- 1) The Heterogeneity of the Microstructure Plays a Key Role for Local Damage and Strain Distributions Near the Crack Tip.
- 2) The High Strain Field Is Localized Within 1 ^{mm} of the Crack Tip.
- 3) Damage Saturation at the Crack Tip Precedes Crack Growth.
- 4) The Damage Distribution Is Roughly Commensurate With the Strain Distribution in the Specimen.
- 5) The Crack Growth process Consists of Blunt-Growth-Blunt and Slow-Fast-Slow Phenomena.